



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Timothy D. Evans et al. : Art Unit: 1731
Serial No.: 09/700,475 : Examiner: M. Steve Alvo
Filed: January 11, 2001 :
For: PEROXIDE, OXYGEN, AND :
PEROXIDE/OXYGEN :
BRIGHTENING OF :
CHEMICAL AND MIXED :
WASTE PULPS :

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TC 1100.000M

DECLARATION OF RAYMOND C. FRANCIS, PH.D.

Assistant Commissioner for Patents
Washington, DC 20231

S I R :

I, Raymond C. Francis, Ph.D., declare that:

1. From May 1, 1987 to date, I have been employed by the State University of New York, College of Environmental Sciences and Forestry at Syracuse, New York. My present position is as a tenured research associate.
2. In August 1996, I entered into a research collaboration with National Silicates Ltd., in Toronto, Ontario, Canada. In the course of this research collaboration, periodic reports were exchanged between myself and researchers at National Silicates Ltd.
3. In February, 1997, I submitted an interim Report on the progress of the Graduate Research Fellowship in Silicate Chemistry to National Silicates Ltd.
4. The Interim Report I submitted to National Silicates Ltd. in February 1997 was an internal communication between research collaborators that was not intended to be publicly disclosed in any manner.

5. To my knowledge, the Interim Report was not published, distributed, or disclosed outside of the research collaboration of National Silicates Ltd. and the State University of New York, Syracuse. The first known publication of the subject matter of the report, to the best of my knowledge, was January 1998.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-identified application or any patent issued thereon.

Dated: 9/20/2002

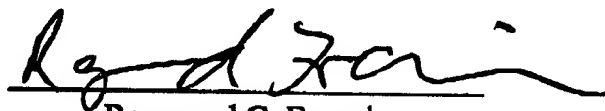

Raymond C. Francis
DECLARANT

Table 1

Effect of Magnesium Sulfate Application on P/O Bleaching of
First ECF Kraft Pulp

	Sample 1	Sample 2	Sample 3	Sample 4
Silicate, % on pulp	4.0	4.0	4.0	4.0
NaOH, % on pulp	2.3	2.3	2.3	2.3
H ₂ O ₂ , % on pulp	1.5	1.5	1.5	1.5
MgSO ₄ ·7H ₂ O % on pulp	0.0	0.25	0.5	0.75
SiO ₂ , % on pulp	1.148	1.148	1.148	1.148
Mg, % on pulp	0.0	0.025	0.050	0.075
Mg:SiO ₂ mass ratio	0	1:46	1:23	1:15
End pH	10.2	10.5	11.0	11.2
Brightness, %	79.8	84.0	84.2	85.3
Yield, %	97.2	97.7	98.1	98.2
Viscosity, cp	8.8	11.4	13.5	14.1
Residual H ₂ O ₂ , %				
30 Minutes	2	25	35	33
60 Minutes	0	15	22	30
120 Minutes	0	2	7	10

Table 1 shows that an MgSO₄·7H₂O charge of 0.25% on pulp (250 ppm Mg on pulp) increased brightness significantly, namely from 79.8% to 84.0%. Also, the brightness increased further when 0.50 and 0.75% MgSO₄·7H₂O was used. The interesting and totally novel result from Table 1 is the increase in pulp yield caused by the addition of magnesium sulfate. Kraft pulps can be dissolved in a solution of cupriethylenediamine, and the viscosity of the solution is an indicator of the degree of polymerization of the cellulose in the pulp. It can be seen that a higher charge of magnesium sulfate also resulted in higher viscosities (less depolymerization of cellulose during H₂O₂ brightening). However, the lowest viscosity (no MgSO₄·7H₂O) corresponds to an average DP of 815. It is unlikely that cellulose molecules of such high DP would solubilize. Therefore, it appears that hemicelluloses were being dissolved. Most likely, the free radicals from H₂O₂ decomposition were causing depolymerization of the hemicelluloses to a degree that resulted in their solubilization.



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ATOMIC WEIGHTS
(Alphabetical Order)

Element	Symbol	Atomic number	Atomic weight	Element	Symbol	Atomic number	Atomic weight	Atomic number	Element
Actinium	Ac	89	227.0278*	Neodymium	Nd	60	144.24	1	Hydrogen
Aluminum	Al	13	26.981539	Neon	Ne	10	20.1797	2	Helium
Americium	Am	95	243.0614*	Neptunium	Np	93	237.0482*	3	Lithium
Antimony	Sb	51	121.75	Nickel	Ni	28	58.69	4	Beryllium
Argon	Ar	18	39.948	Niobium	Nb	41	92.90638	5	Boron
Arsenic	As	33	74.92159	Nitrogen	N	7	14.00674	6	Carbon
Astatine	At	85	209.9871*	Nobelium	No	102	259.1009*	7	Nitrogen
Barium	Ba	56	137.327	Osmium	Os	76	190.2	8	Oxygen
Berkelium	Bk	97	247.0703*	Oxygen	O	8	15.9994	9	Fluorine
Beryllium	Be	4	9.012182	Palladium	Pd	46	106.42	10	Neon
Bismuth	Bi	83	208.98037	Phosphorus	P	15	30.973762	11	Sodium
Boron	B	5	10.811	Platinum	Pt	78	195.08	12	Magnesium
Bromine	Br	35	79.904	Plutonium	Pu	94	244.0642*	13	Aluminum
Cadmium	Cd	48	112.411	Polonium	Po	84	208.9824*	14	Silicon
Calcium	Ca	20	40.078	Potassium	K	19	39.0983	15	Phosphorus
Californium	Cf	98	251.0796*	Praseodymium	Pr	59	140.90765	16	Sulfur
Carbon	C	6	12.011	Promethium	Pm	61	144.9127*	17	Chlorine
Cerium	Ce	58	140.115	Protactinium	Pa	91	231.0359*	18	Argon
Cesium	Cs	55	132.90543	Radium	Ra	88	226.0254*	19	Potassium
Chlorine	Cl	17	35.4527	Radon	Rn	86	222.0176*	20	Calcium
Chromium	Cr	24	51.9961	Rhenium	Re	75	186.207	21	Scandium
Cobalt	Co	27	58.93320	Rhodium	Rh	45	102.90550	22	Titanium
Copper	Cu	29	63.546	Rubidium	Rb	37	85.4678	23	Vanadium
Curium	Cm	96	247.0703*	Ruthenium	Ru	44	101.07	24	Chromium
Dysprosium	Dy	66	162.50	Samarium	Sm	62	150.36	25	Manganese
Einsteinium	Es	99	252.083*	Scandium	Sc	21	44.955910	26	Iron
Erbium	Er	68	167.26	Selenium	Se	34	78.96	27	Cobalt
Europium	Eu	63	151.965	Silicon	Si	14	28.0855	28	Nickel
Fermium	Fm	100	257.0951*	Silver	Ag	47	107.8682	29	Copper
Fluorine	F	9	18.9984032	Sodium	Na	11	22.989768	30	Zinc
Francium	Fr	87	223.0197*	Strontium	Sr	38	87.62	31	Gallium
Gadolinium	Gd	64	157.25	Sulfur	S	16	32.066	32	Germanium
Gallium	Ga	31	69.723	Tantalum	Ta	73	180.9479	33	Arsenic
Germanium	Ge	32	72.61	Technetium	Tc	43	97.9072*	34	Selenium
Gold	Au	79	196.96654	Tellurium	Te	52	127.60	35	Bromine
Hafnium	Hf	72	178.49	Terbium	Tb	65	158.92534	36	Krypton
Helium	He	2	4.002602	Thallium	Tl	81	204.3833	37	Rubidium
Holmium	Ho	67	164.93032	Thorium	Th	90	232.0381	38	Strontium
Hydrogen	H	1	1.00794	Thulium	Tm	69	168.93421	39	Yttrium
Indium	In	49	114.82	Tin	Sn	50	118.710	40	Zirconium
Iodine	I	53	126.90447	Titanium	Ti	22	47.88	41	Niobium
Iridium	Ir	77	192.22	Tungsten	W	74	183.85	42	Molybdenum
Iron	Fe	26	55.847	Unnilquadium	Unq	104	261.11*	43	Technetium
Krypton	Kr	36	83.80	Unnilpentium	Unp	105	262.114*	44	Ruthenium
Lanthanum	La	57	138.9055	Unnilhexium	Unh	106	263.118*	45	Rhodium
Lawrencium	Lr	103	262.11*	Unnilseptium	Uns	107	262.12*	46	Palladium
Lead	Pb	82	207.2	Uranium	U	92	238.0289	47	Silver
Lithium	Li	3	6.941	Vanadium	V	23	50.9415	48	Cadmium
Lutetium	Lu	71	174.967	Xenon	Xe	54	131.29	49	Indium
Magnesium	Mg	12	24.3050	Ytterbium	Yb	70	173.04	50	Tin
Manganese	Mn	25	54.93805	Yttrium	Y	39	88.90585	51	Antimony
Mendelevium	Md	101	258.10*	Zinc	Zn	30	65.39	52	Tellurium
Mercury	Hg	80	200.59	Zirconium	Zr	40	91.224	53	Iodine
Molybdenum	Mo	42	95.94					54	Xenon

Based on 1987 IUPAC Table of Standard Atomic Weights of the Elements.

* Relative atomic mass of the isotope of that element with the longest known half-life.

Based on 1987 IUPAC

* Relative atomic mass